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Date: March 17, 2004

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From: Lou Ann Donatoni Telephone/Ext.: (973) 235-4389  
Dept.: Patent Law Return Fax: (973) 235-2363

No. Pages Including Coversheet: 3

Remarks: **Deposit Account 08-2525 - Request for Refund**

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**In reviewing our on-line statement for March 2004, I have noticed the following discrepancy:**

**The two charges posted to our Deposit Account No. 08-2525 on 03/09/2004, Control No. 16 – USSN 10/720,908, fee code 1202 (\$6,120.00) and Control No. 17 – USSN 10/720,908, fee code 1203 (\$290.00) are erroneous. There were no multiple dependent claims filed in this application.**

**There total number of claims filed in this application is ninety (90). The fee for the seventy (70) extra claims, \$1,260.00, was charged against our Deposit Account No. 08-2525 on 12/02/2003, Control No. 146, fee code 1202.**

**Please credit our deposit account in the amount of \$6,410.00 as soon as possible.**

140343



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Patent and  
Trademark Office

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Deposit Account Statement

Requested Statement Month:

March 2004

Deposit Account Number:

082525

Name:

HOFFMANN LA ROCHE

Attention:

PATENT DEPT.

Address:

340 KINGSLAND STREET

City:

NUTLEY

State:

NJ

Zip:

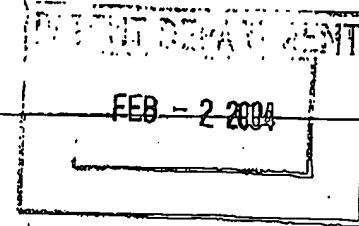
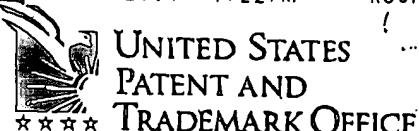
07110

DATE	SEQ	POSTING REF	ATTORNEY DOCKET NBR	FEE CODE	AMT	BAL
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* 03/09 17 10720908 21431 US1				1203	\$290.00	\$137,599.07
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				8014	\$175.00	\$137,249.07
03/10	10	10793296	21573 US1	1001	\$770.00	\$136,479.07

MAR. 17. 2004 4:22PM

ROCHE PATENT LAW

NO. 0421 P. 3



## MONTHLY STATEMENT OF DEPOSIT ACCOUNT

To replenish your deposit account, detach and return top portion with your check. Make check payable to Director of Patents & Trademarks.

HOFFMANN LA ROCHE  
PATENT DEPT.  
340 KINGSLAND STREET

FINA

NUTLEY NJ 07110

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082525
Date
12-31-03
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1

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Chicago, IL 60673

DATE POSTED	CONTROL NO.	DESCRIPTION (Serial, Patent, TM, Order)	DOCKET NO.	FEES CODE	CHARGES/ CREDITS	BALANCE	
MO.	DAY	YR.					
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AN AMOUNT SUFFICIENT TO  
COVER ALL SERVICES REQUESTED  
MUST ALWAYS BE ON DEPOSIT

OPENING BALANCE

TOTAL CHARGES

TOTAL CREDITS

CLOSING BALANCE

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**RAM** Fee History  
Query  
Revenue Accounting and Management

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Name/Number: 10720908

Total Records Found: 7

Start Date: Any Date

End Date: Any Date

Accounting Date	Sequence Num.	Tran Type	Fee Code	Fee Amount	Mailroom Date	Payment Method
12/02/2003	00000144	1	<u>1001</u>	\$770.00	11/24/2003	DA 082525
12/02/2003	00000145	1	<u>1202</u>	\$1,260.00	11/24/2003	DA 082525
12/02/2003	00000146	1	<u>1201</u>	\$946.00	11/24/2003	DA 082525
03/09/2004	00000014	1	<u>1201</u>	-\$946.00	11/24/2003	DA 082525
03/09/2004	00000015	1	<u>1201</u>	\$860.00	12/02/2003	DA 082525
03/09/2004	00000016	1	<u>1202</u>	\$6,120.00	12/02/2003	DA 082525
03/09/2004	00000017	1	<u>1203</u>	\$290.00	12/02/2003	DA 082525

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Query  
Revenue Accounting and Management

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Name/Number: 10720908  
Start Date: Any Date

Total Records Found: 7  
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12/02/2003	00000144	1	<u>1001</u>	\$770.00	11/24/2003	DA 082525
12/02/2003	00000145	1	<u>1202</u>	\$1,260.00	11/24/2003	DA 082525
12/02/2003	00000146	1	<u>1201</u>	\$946.00	11/24/2003	DA 082525
03/09/2004	00000014	1	<u>1201</u>	-\$946.00	11/24/2003	DA 082525
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03/09/2004	00000017	1	<u>1203</u>	\$290.00	12/02/2003	DA 082525

Claim 87, 88, 89 and 90 are  
multiple

PATENT APPLICATION FEE DETERMINATION RECORD  
Effective October 1, 2003

Application or Docket Number

10/720,908

CLAIMS AS FILED - PART I

(Column 1) (Column 2)

TOTAL CLAIMS	90	
FOR	NUMBER FILED	NUMBER EXTRA
TOTAL CHARGEABLE CLAIMS	430 minus 20 =	410
INDEPENDENT CLAIMS	13 minus 3 =	10
MULTIPLE DEPENDENT CLAIM PRESENT		<input checked="" type="checkbox"/>

SMALL ENTITY  
TYPE

OTHER THAN  
OF SMALL ENTITY

RATE	FEES	RATE	FEES
BASIC FEE	385.00	OR BASIC FEE	770.00
XS 9=		OR XS18=	7380
X43=		OR X86=	860
+145=		OR +290=	290
TOTAL		OR TOTAL	9380

\* If the difference in column 1 is less than zero, enter "0" in column 2

CLAIMS AS AMENDED - PART II

(Column 1) (Column 2) (Column 3)

AMENDMENT A		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA
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	Independent	*	Minus	***	=
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM					<input type="checkbox"/>

SMALL ENTITY

OR

OTHER THAN  
SMALL ENTITY

RATE	ADDI- TIONAL FEE	RATE	ADDI- TIONAL FEE
XS 9=		OR XS18=	
X43=		OR X86=	
+145=		OR +290=	
TOTAL ADDIT. FEE		OR TOTAL ADDIT. FEE	

AMENDMENT B		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA
		Total	Minus	**	=
	Independent	*	Minus	***	=
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM					<input type="checkbox"/>

ADDI-  
TIONAL  
FEE

ADDI-  
TIONAL  
FEE

RATE	ADDI- TIONAL FEE	RATE	ADDI- TIONAL FEE
XS 9=		OR XS18=	
X43=		OR X86=	
+145=		OR +290=	
TOTAL ADDIT. FEE		OR TOTAL ADDIT. FEE	

AMENDMENT C		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA
		Total	Minus	**	=
	Independent	*	Minus	***	=
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM					<input type="checkbox"/>

ADDI-  
TIONAL  
FEE

ADDI-  
TIONAL  
FEE

RATE	ADDI- TIONAL FEE	RATE	ADDI- TIONAL FEE
XS 9=		OR XS18=	
X43=		OR X86=	
+145=		OR +290=	
TOTAL ADDIT. FEE		OR TOTAL ADDIT. FEE	

\* If the entry in column 1 is less than the entry in column 2, write "0" in column 3

\*\* If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20"

\*\*\* If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3"

The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1

Claims

1. A device for performing a needleless hypodermic injection of a liquid medication contained in the device, said device comprising pyrotechnical means for generating within the device a pressure necessary for injecting the medication, said device comprising ignition means for igniting a propellant contained in said device, said ignition means comprising

an impact initiated primer material and a firing pin for striking said primer material, said primer material being so positioned with respect to said propellant that when the firing pin strikes the primer material the hot products of combustion of said primer material ignite said propellant.

2. The device according to claim 1, wherein the impact initiated primer material is contained in a hollow rim of a shell case and the firing pin is adapted for crushing the rim at one point when actuated.

3. The device according to claim 1, wherein the impact initiated primer material is part of a centerfire primer arrangement consisting of a deformable cup, an anvil, and primer material, in which arrangement the firing pin indents the cup and crushes the primer material against the anvil when actuated.

4. The device according to claim 1, wherein ignition of the primer material alone produces sufficient gas volume and pressure that no additional propellant is needed for performing an injection with the device.

5. The device according to claim 1, wherein ignition of the primer material produces a first, fast high pressure pulse that starts the injection, and at the same time ignites a slower burning propellant that provides over a longer duration a lower pressure for completing the injection.

6. The device according to claim 1, wherein said primer material is contained in a container sealed with a frangible closure that excludes contact of the primer material with water vapor prior to use of the device.

7. The device according to claim 2, wherein the open end of the shell case is sealed with a frangible closure that excludes penetration of water vapor into the shell case prior to use of the device.

8. The device according to claim 2, wherein at least a portion of the propellant is contained within the shell case.

9. The device according to claim 7, wherein a portion of the propellant within the shell case has properties which are different from the properties of a portion of the propellant outside the shell case.

10. The device according to claim 3, wherein the primer material is sealed with a frangible closure that excludes contact of the primer material with water vapor prior to use of the device.

11. The device according to claim 1, said device further comprising

- (a) a housing,
- (b) a first chamber within said housing, said first chamber containing a medication unit configured and dimensioned to store a volume of liquid medication to be injected, said medication unit having a first region and a second region that are in liquid communication with each other, said first region being deformable and said second region having an ejection outlet, and
- (c) a second chamber within said housing, said second chamber containing a propellant, said first chamber comprising two zones, a first zone containing said medication unit and a second zone which is in communication with said second chamber, so that upon ignition of the propellant in the second chamber gas generated thereby expands into said second zone of said first chamber, exerts pressure on and deforms said deformable first region of said medication unit and thereby causes ejection of said liquid medication through said ejection outlet.

12. The device according to claim 11, wherein said propellant is contained in a propellant chamber having a wall which has a zone of reduced thickness which upon ignition of said propellant bursts and thereby forms an opening of said wall when gas pressure within the propellant chamber exceeds a predetermined value.

13. The device according to claim 1, said device further comprising

- (a) a nozzle body, and
- (b) a rigid housing,

said housing having a first open end adapted to receive and be connected with the nozzle body and a second closed end,

the interior of said housing defining a chamber which extends between said open end and said closed end of the housing, said chamber being adapted to receive

a first deformable diaphragm which together with a cavity of said nozzle body forms a medication chamber suitable for receiving a predetermined amount of a medication, and

a second deformable diaphragm a portion of which extends around a portion of said first deformable diaphragm,

said second deformable diaphragm and said housing forming together a chamber for receiving a propellant and means for igniting said propellant, and

said nozzle body having at its outer end an orifice which is the outlet of a channel for ejecting said medication out of said chamber when a gas pressure generated by ignition of said propellant is applied to said second deformable diaphragm and thereby to said first deformable diaphragm.

14. The device according to claim 13, wherein said nozzle body and said housing are integrally built as a single-piece element and are made of one and the same material.

15. The device according to claim 13, further comprising venting means for venting of the space comprised between the first deformable diaphragm and the second deformable diaphragm.

16. The device according to claim 13, without said second deformable diaphragm.

17. The device according to claim 1, said device further comprising

- (a) a rigid medication container having a medication zone for receiving said liquid medication,
- (b) a nozzle in fluidic communication with said medication zone, said nozzle having an outlet orifice,
- (c) a propellant zone where said propellant is located within said device,

(d) a channel that fluidically connects said propellant zone with said medication zone, and  
(e) piston means slidably arranged within said channel, so that upon ignition of said propellant gas pressure generated by combustion of the propellant causes displacement of said piston means which then exert pressure on said liquid medication and eject it through the outlet orifice of said nozzle.

18. A device for performing a needleless hypodermic injection of a liquid medication contained in the device, said device including pyrotechnical means for generating within the device a pressure necessary for injecting the medication, said device comprising ignition means for igniting a propellant contained in said device, said ignition means comprising

(a) a first body having a cavity, said cavity having an outlet through which the interior of the cavity is fluidically connected with a zone within the device where said propellant is located, said first body being deformable by bending it,

(b) a second body arranged within said cavity so that a portion of the outer surface of the second body is spaced from a portion of the inner surface of said first body, said second body being to some extent elastically deformable by bending it, but adapted to be broken when that bending exceeds a predetermined threshold value, and

(c) said portion of the outer surface of the second body and said portion of the inner surface of said first body facing each other and one or both of those surface portions being coated with an impact sensitive pyrotechnic material, whereby an impact of said surface portions on each other caused by breaking the second body by bending of the first body and thereby bending of the second body beyond said threshold value ignites said impact sensitive pyrotechnic material and the products of this ignition ignite the propellant.

19. A device for performing a needleless hypodermic injection of a liquid medication contained in the device, said device including pyrotechnical means for generating within the device a pressure necessary for injecting the medication, said device comprising ignition means for igniting a propellant contained in said device, said ignition means comprising

(a) a tube having a closed end and an open end through which the interior of the tube is fluidically connected with a zone within the device where said propellant is located, said tube being deformable by bending it, and

(b) a breakable rod arranged within said tube so that a portion of the outer surface of the rod is spaced from a portion of the inner surface of said tube, said rod being to some extent elastically deformable by bending it, but adapted to be broken when that bending exceeds a predetermined threshold value,

said portion of the outer surface of the rod and said portion of the inner surface of said tube facing each other and one or both of those surface portions being coated with an impact sensitive pyrotechnic material, whereby an impact of said surface portions on each other caused by breaking the rod by bending of the tube containing the rod beyond said threshold value ignites said impact sensitive pyrotechnic material and the products of this ignition ignite the propellant.

20. The device according to claim 18, wherein the outlet of the cavity is sealed with a frangible closure that excludes penetration of water vapor into said cavity prior to use of the device.

21. The device according to claim 19, wherein the open end of said tube is sealed with a frangible closure that excludes penetration of water vapor into the interior of said tube prior to use of the device.

22. The device according to claim 18, wherein a secondary ignition material is provided and located outside of said cavity and near the outlet of the cavity, so that products of combustion of the impact sensitive pyrotechnic material ignite the secondary ignition material and thereby increase the amount of hot material for igniting the propellant.

23. The device according to claim 18, wherein a secondary ignition material is provided and located inside of said cavity and near the outlet of the cavity, so that products of combustion of the impact sensitive pyrotechnic material ignite the secondary ignition material and thereby increase the amount of hot material for igniting the propellant.

24. The device according to claim 18, wherein one of those surface portions which face each other is coated with an impact sensitive pyrotechnic material and the other is coated with a secondary ignition material.

25. The device according to claim 18, wherein one or both of those surface portions which face each other is coated with a layer of an impact sensitive pyrotechnic material and a layer of a secondary ignition material.

26. The device according to claim 19, wherein a secondary ignition material is provided and located outside of said tube and near the outlet of said tube, so that products of combustion of the impact sensitive pyrotechnic material ignite the secondary ignition material and thereby increase the amount of hot material for igniting the propellant.

27. The device according to claim 19, wherein a secondary ignition material is provided and located ~~7~~inside of said tube and near the outlet of said tube, so that products of combustion of the impact sensitive pyrotechnic material ignite the secondary ignition material and thereby increase the amount of hot material for igniting the propellant.

28. The device according to claim 19, wherein one of those surface portions which face each other is coated with an impact sensitive pyrotechnic material and the other is coated with a secondary ignition material.

29. The device according to claim 19, wherein one or both of those surface portions which face each other is coated with a layer of an impact sensitive pyrotechnic material and a layer of a secondary ignition material.

30. The device according to claim 18, said device further comprising

(a) a housing,

(b) a first chamber within said housing, said first chamber containing a medication unit configured and dimensioned to store a volume of liquid medication to be injected, said medication unit having a first region and a second region that are in liquid communication with each other, said first region being deformable and said second region having an ejection outlet, and

(c) a second chamber within said housing, said second chamber containing a propellant, said first chamber comprising two zones, a first zone containing said medication unit and a second zone which is in communication with said second chamber, so that upon ignition of the propellant in the second chamber gas generated thereby expands into said second zone of said first chamber, exerts pressure on and deforms said deformable first region of said medication unit and thereby causes ejection of said liquid medication through said ejection outlet.

31. The device according to claim 30, wherein said propellant is contained in a propellant chamber having a wall which has a zone of reduced thickness which upon ignition of said propellant bursts and thereby forms an opening of said wall when gas pressure within the propellant chamber exceeds a predetermined value.

32. The device according to claim 18, said device further comprising

(a) a nozzle body, and

(b) a rigid housing,

said housing having

a first open end adapted to receive and be connected with the nozzle body and a second closed end,

the interior of said housing defining a chamber which extends between said open end and said closed end of the housing, said chamber being adapted to receive

a first deformable diaphragm which together with a cavity of said nozzle body forms a medication chamber suitable for receiving a predetermined amount of a medication, and

a second deformable diaphragm a portion of which extends around a portion of said first deformable diaphragm,

said second deformable diaphragm and said housing forming together a chamber for receiving a propellant and means for igniting said propellant,

    said nozzle body having at its outer end an orifice which is the outlet of a channel for ejecting said medication out of said chamber when a gas pressure generated by ignition of said propellant is applied to said second deformable diaphragm and thereby to said first deformable diaphragm.

33. The device according to claim 32, wherein said nozzle body and said housing are integrally built as a single-piece element and are made of one and the same material.

34. The device according to claim 32, further comprising venting means for venting of the space comprised between the first deformable diaphragm and the second deformable diaphragm.

35. The device according to claim 32, without said second deformable diaphragm.

36. The device according to claim 18, said device further comprising

    (a) a rigid medication container having a medication zone for receiving said liquid medication,

    (b) a nozzle in fluidic communication with said medication zone, said nozzle having an outlet orifice,

    (c) a propellant zone where said propellant is located within said device,

    (d) a channel that fluidically connects said propellant zone with said medication zone, and

    (e) piston means slidably arranged within said channel, so that upon ignition of said propellant gas pressure generated by combustion of the propellant causes displacement of said piston means which then exert pressure on said liquid medication and eject it through the outlet orifice of said nozzle.

37. A device for performing a needleless hypodermic injection of a liquid medication contained in a medication unit within the device, said device including pyrotechnical means for generating within the device a pressure necessary for injecting the medication, said device comprising ignition means for igniting a propellant contained in said device, said ignition means comprising

(a) a first body having a cavity, said cavity having an outlet through which the interior of the cavity is fluidically connected with a zone within the device where said propellant is located, the tubular portion of said first body being deformable by a localized impact from one side,

(b) a solid anvil arranged within said tube so that a portion of the outer surface of the anvil is spaced from a portion of the inner surface of said tube, and

(c) means for effecting a mechanical impact on a spot of the outer surface of said first body, said portion of the outer surface of the anvil and said portion of the inner surface of said tube facing each other and one or both of those surface portions being coated with an impact sensitive pyrotechnic material, whereby an impact of said surface portions on each other effected by said means for effecting a mechanical impact ignites said pyrotechnic material and the products of this ignition ignite the propellant.

38. A device for performing a needleless hypodermic injection of a liquid medication contained in a medication unit within the device, said device including pyrotechnical means for generating within the device a pressure necessary for injecting the medication, said device comprising

a) a zone within the device where a propellant is located, and

b) ignition means for igniting said propellant, said ignition means comprising

(b.1) a hollow body having a cavity, said cavity having an outlet through which the interior of the cavity is fluidically connected with said zone where the propellant is located, a portion of said first hollow body being deformable by a localized impact from one side, a portion of the inner surface of the hollow body being coated with an impact sensitive pyrotechnic material, and

(b.2) means for effecting a mechanical impact on a spot of the outer surface of said hollow body, said spot lying on a point of the outer surface of said hollow body which is opposite to said portion of the inner surface which is coated with an impact sensitive pyrotechnic material, whereby an impact of said spot caused by actuation of said impact effecting means ignites said impact sensitive pyrotechnic material and the products of this ignition ignite the propellant.

39. The device according to claim 37, wherein said means for effecting a mechanical impact comprise a spring mechanism which is arranged for impacting on said spot when a trigger releases a latch.

40. The device according to claim 38, wherein the outlet of the cavity is sealed with a frangible closure that excludes penetration of water vapor into said cavity prior to use of the device.

41. The device according to claim 37, wherein a secondary ignition material is provided and located outside of said cavity and near the outlet of the cavity, so that products of combustion of the impact sensitive pyrotechnic material ignite the secondary ignition material and thereby increase the amount of hot material for igniting the propellant.

42. The device according to claim 38, wherein a secondary ignition material is provided and located inside of said cavity and near the outlet of said cavity, so that products of combustion of the impact sensitive pyrotechnic material ignite the secondary ignition material and thereby increase the amount of hot material for igniting the propellant.

43. The device according to claim 39, wherein one of those surface portions which face each other is coated with an impact sensitive pyrotechnic material and the other is coated with a secondary ignition material.

44. The device according to claim 37, wherein one or both of those surface portions which face each other is coated with a layer of an impact sensitive pyrotechnic material and a layer of a secondary ignition material.

45. The device according to claim 38, said device further comprising

(a) a housing,

(b) a first chamber within said housing, said first chamber containing a medication unit configured and dimensioned to store a volume of liquid medication to be injected, said medication

unit having a first region and a second region that are in liquid communication with each other, said first region being deformable and said second region having an ejection outlet, and

(c) a second chamber within said housing, said second chamber containing a propellant,

said first chamber comprising two zones, a first zone containing said medication unit and a second zone which is in communication with said second chamber, so that upon ignition of the propellant in the second chamber gas generated thereby expands into said second zone of said first chamber, exerts pressure on and deforms said deformable first region of said medication unit and thereby causes ejection of said liquid medication through said ejection outlet.

46. The device according to claim 45, wherein said propellant is contained in a propellant chamber having a wall which has a zone of reduced thickness which upon ignition of said propellant bursts and thereby forms an opening of said wall when gas pressure within the propellant chamber exceeds a predetermined value.

47. The device according to claim 37, said device further comprising

(a) a nozzle body, and

(b) a rigid housing,

said housing having a first open end adapted to receive and be connected with the nozzle body and a second closed end,

the interior of said housing defining a chamber which extends between said open end and said closed end of the housing, said chamber being adapted to receive

a first deformable diaphragm which together with a cavity of said nozzle body forms a medication chamber suitable for receiving a predetermined amount of a medication, and

a second deformable diaphragm a portion of which extends around a portion of said first deformable diaphragm,

said second deformable diaphragm and said housing forming together a chamber for receiving a propellant and means for igniting said propellant,

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said nozzle body having at its outer end an orifice which is the outlet of a channel for ejecting said medication out of said chamber when a gas pressure generated by ignition of said propellant is applied to said second deformable diaphragm and thereby to said first deformable diaphragm.

48. The device according to claim 47, wherein said nozzle body and said housing are integrally built as a single-piece element and are made of one and the same material.

49. The device according to claim 47, further comprising venting means for venting of the space comprised between the first deformable diaphragm and the second deformable diaphragm.

50. The device according to claim 47, without said second deformable diaphragm.

51. The device according to any of claim 37, said device further comprising  
(a) a rigid medication container having a medication zone for receiving said liquid medication,  
(b) a nozzle in fluidic communication with said medication zone, said nozzle having an outlet orifice,  
(c) a propellant zone where said propellant is located within said device,  
(d) a channel that fluidically connects said propellant zone with said medication zone, and  
(e) piston means slidably arranged within said channel, so that upon ignition of said propellant gas pressure generated by combustion of the propellant causes displacement of said piston means which then exert pressure on said liquid medication and eject it through the outlet orifice of said nozzle.

52. A device for performing a needless hypodermic injection of a liquid medication contained in a medication unit within the device, said device including pyrotechnical means for generating within the device a pressure necessary for injecting the medication, said device comprising ignition means for igniting a propellant contained in said device, said ignition means comprising

(a) a pair of hypergolic members formed by a first and a second hypergolic member which are contained within the device, but separated from each other,

said hypergolic members being able to chemically react with each other when brought into contact with each other and which thereby generate heat for igniting said propellant, and

(b) means for bringing said first and a second hypergolic member into contact with each other.

53. A device for performing a needleless hypodermic injection of a liquid medication contained in a medication unit within the device, said device including pyrotechnical means for generating within the device a pressure necessary for injecting the medication, said device comprising ignition means for igniting a propellant contained in said device, said ignition means comprising

(a) a first tube having a closed end and an open end through which the interior of the tube is fluidically connected with a zone within the device where said propellant is located, said tube being deformable by bending it, and

(b) a second tube closed at both ends and arranged within said first tube so that at least a portion of the outer surface of the second tube is spaced from a portion of the inner surface of said first tube, said second tube being breakable by bending the first tube when that bending exceeds a predetermined threshold value,

said second tube containing a first member of an hypergolic pair, and

(c) a second member of an hypergolic pair contained in a space between the inner surface of the first tube and the outer surface of the second tube, whereby when said second tube is broken by bending of the first tube beyond said threshold value the first member and the second member of the hypergolic pair contact each other and their chemical reaction causes an ignition and the products of this ignition ignite the propellant.

54. The device according to claim 53, wherein the outlet of the first tube is sealed with a frangible closure that excludes penetration of water vapor into said first tube prior to use.

55. The device according to claim 53, wherein a secondary ignition material is provided and located outside of said first tube and near the outlet of the first tube, so that products of combustion of the hypergolic pair ignite the secondary ignition material and thereby increase the amount of hot material for igniting the propellant.

56. The device according to claim 53, wherein a secondary ignition material is provided and located inside of said first tube and near the outlet of said first tube, so that products of combustion of the hypergolic pair ignite the secondary ignition material and thereby increase the amount of hot material for igniting the propellant.

57. A device for performing a needleless hypodermic injection of a liquid medication contained in a medication unit within the device, said device including pyrotechnical means for generating within the device a pressure necessary for injecting the medication, said device comprising ignition means for igniting a propellant contained in said device, said ignition means comprising

(a) an elongated container having a closed end and an open end through which the interior of the container is fluidically connected with a zone within the device where said propellant is located, said container being deformable by bending it,

(b) a first tube closed at both ends and arranged within said container, said first tube containing a first member of an hypergolic pair, and

(c) a second tube closed at both ends and arranged within said container, said second tube containing a second member of an hypergolic pair,

said first and second tubes being breakable by bending the container when that bending exceeds a predetermined threshold value, whereby when the first and second tubes are broken by bending of the container beyond said threshold value the first member and the second member of the hypergolic pair contact each other and their chemical reaction causes an ignition and the products of this ignition ignite the propellant.

58. The device according to claim 57, wherein the outlet of said container is sealed with a frangible closure that excludes penetration of water vapor into said first tube prior to use.

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59. A device according to claim 57, wherein a secondary ignition material is provided and located near the breaking points of said first and second tubes, so that products of combustion of the hypergolic pair ignite the secondary ignition material and thereby increase the amount of hot material for igniting the propellant.

60. The device according to claim 57, wherein a secondary ignition material is provided and located outside of said container and near the outlet of said container, so that products of combustion of the hypergolic pair ignite the secondary ignition material and thereby increase the amount of hot material for igniting the propellant.

61. The device according to claim 57, wherein a secondary ignition material is provided and located inside of said container and near the outlet of said container, so that products of combustion of the hypergolic pair ignite the secondary ignition material and thereby increase the amount of hot material for igniting the propellant.

62. The device according to claim 52, said device further comprising

(a) a housing,

(b) a first chamber within said housing, said first chamber containing a medication unit configured and dimensioned to store a volume of liquid medication to be injected, said medication unit having a first region and a second region that are in liquid communication with each other, said first region being deformable and said second region having an ejection outlet, and

(c) a second chamber within said housing, said second chamber containing a propellant, said first chamber comprising two zones, a first zone containing said medication unit and a second zone which is in communication with said second chamber, so that upon ignition of the propellant in the second chamber gas generated thereby expands into said second zone of said first chamber, exerts pressure on and deforms said deformable first region of said medication unit and thereby causes ejection of said liquid medication through said ejection outlet.

63. The device according to claim 62, wherein said propellant is contained in a propellant chamber having a wall which has a zone of reduced thickness which upon ignition of said propellant bursts and thereby forms an opening of said wall when gas pressure within the propellant chamber exceeds a predetermined value.

64. The device according to claim 52, said device further comprising

(a) a nozzle body, and

(b) a rigid housing,

said housing having a first open end adapted to receive and be connected with the nozzle body and a second closed end,

the interior of said housing defining a chamber which extends between said open end and said closed end of the housing, said chamber being adapted to receive

a first deformable diaphragm which together with a cavity of said nozzle body forms a medication chamber suitable for receiving a predetermined amount of a medication, and

a second deformable diaphragm a portion of which extends around a portion of said first deformable diaphragm,

said second deformable diaphragm and said housing forming together a chamber for receiving a propellant and means for igniting said propellant,

said nozzle body having at its outer end an orifice which is the outlet of a channel for ejecting said medication out of said chamber when a gas pressure generated by ignition of said propellant is applied to said second deformable diaphragm and thereby to said first deformable diaphragm.

65. The device according to claim 64, wherein said nozzle body and said housing are integrally built as a single-piece element and are made of one and the same material.

66. The device according to claim 64, further comprising venting means for venting of the space comprised between the first deformable diaphragm and the second deformable diaphragm.

67. The device according to claim 64, without said second deformable diaphragm.

68. The device according to claim 52, said device further comprising

- (a) a rigid medication container having a medication zone for receiving said liquid medication,
- (b) a nozzle in fluidic communication with said medication zone, said nozzle having an outlet orifice,
- (c) a propellant zone where said propellant is located within said device,
- (d) a channel that fluidically connects said propellant zone with said medication zone, and
- (e) piston means slidably arranged within said channel, so that upon ignition of said propellant gas pressure generated by combustion of the propellant causes displacement of said piston means which then exert pressure on said liquid medication and eject it through the outlet orifice of said nozzle.

69. A device for performing a needleless hypodermic injection of a liquid medication contained in a medication unit within the device, said device including pyrotechnical means for generating within the device a pressure necessary for injecting the medication, said device comprising ignition means for igniting a propellant contained in said device, said ignition means comprising

- (a) a rotatable body,
- (b) a stationary body,
- (c) means for pressing at least a portion of said rotatable body against said stationary body, a portion of the outer surface of said rotatable body being thereby in contact with said stationary body and  
at least a part of said portion of the outer surface of said rotatable body or at least a part of the outer surface of said stationary body being coated with a combustible mixture that bursts into flame when activated by friction,
- (d) locking means that when locked prevent rotation of said rotatable body, and
- (e) means for rotating said rotatable body when said locking means are unlocked, said rotation causing a friction of said combustible mixture against an outer surface of said stationary

body or an outer surface of said stationary body and thereby ignition of said mixture, the products of this ignition igniting the propellant.

70. A device for performing a needleless hypodermic injection of a liquid medication contained in a medication unit within the device, said device including pyrotechnical means for generating within the device a pressure necessary for injecting the medication, said device comprising ignition means for igniting a propellant contained in said device, said ignition means comprising

(a) a rotatable body,

(b) a stationary body,

(c) means for pressing at least a portion of said rotatable body against said stationary body, a portion of the outer surface of said rotatable body being thereby in contact with said stationary body and

at least a part of said portion of the outer surface of said rotatable body being coated with a first member of an hypergolic pair, and at least a part of the outer surface of said stationary body being coated with a second member of an hypergolic pair,

(d) locking means that when locked prevent rotation of said rotatable body,

(e) means for rotating said rotatable body when said locking means are unlocked, said rotation bringing said first and second hypergolic member into contact with each other, thereby causing their chemical reaction and a resulting ignition, the products of this ignition igniting the propellant.

71. The device according to claim 69, wherein said rotatable body and said stationary body are in a zone closed by a frangible closure that protects coatings on those bodies against effects of humidity.

72. The device according to claim 69, wherein a secondary ignition material is provided and located near to the zone where the rotatable body and the stationary body contact each other.

73. The device according to claim 69, said device further comprising

(a) a housing,

(b) a first chamber within said housing, said first chamber containing a medication unit configured and dimensioned to store a volume of liquid medication to be injected, said medication unit having a first region and a second region that are in liquid communication with each other, said first region being deformable and said second region having an ejection outlet, and

(c) a second chamber within said housing, said second chamber containing a propellant, said first chamber comprising two zones, a first zone containing said medication unit and a second zone which is in communication with said second chamber, so that upon ignition of the propellant in the second chamber gas generated thereby expands into said second zone of said first chamber, exerts pressure on and deforms said deformable first region of said medication unit and thereby causes ejection of said liquid medication through said ejection outlet.

74. The device according to claim 73, wherein said propellant is contained in a propellant chamber having a wall which has a zone of reduced thickness which upon ignition of said propellant bursts and thereby forms an opening of said wall when gas pressure within the propellant chamber exceeds a predetermined value.

75. The device according to claim 69, said device further comprising

(a) a nozzle body, and

(b) a rigid housing,

said housing having a first open end adapted to receive and be connected with the nozzle body and a second closed end,

the interior of said housing defining a chamber which extends between said open end and said closed end of the housing, said chamber being adapted to receive

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a first deformable diaphragm which together with a cavity of said nozzle body forms a medication chamber suitable for receiving a predetermined amount of a medication, and  
a second deformable diaphragm a portion of which extends around a portion of said first deformable diaphragm,  
said second deformable diaphragm and said housing forming together a chamber for receiving a propellant and means for igniting said propellant,  
said nozzle body having at its outer end an orifice which is the outlet of a channel for ejecting said medication out of said chamber when a gas pressure generated by ignition of said propellant is applied to said second deformable diaphragm and thereby to said first deformable diaphragm.

76. The device according to claim 75, wherein said nozzle body and said housing are integrally built as a single-piece element and are made of one and the same material.

77. The device according to claim 75, further comprising venting means for venting of the space comprised between the first deformable diaphragm and the second deformable diaphragm.

78. The device according to claim 75, without said second deformable diaphragm.

79. The device according to claim 69, said device further comprising

(a) a rigid medication container having a medication zone for receiving said liquid medication,  
(b) a nozzle in fluidic communication with said medication zone, said nozzle having an outlet orifice,  
(c) a propellant zone where said propellant is located within said device,  
(d) a channel that fluidically connects said propellant zone with said medication zone, and  
(e) piston means slidably arranged within said channel, so that upon ignition of said propellant gas pressure generated by combustion of the propellant causes displacement of said piston means which then exert pressure on said liquid medication and eject it through the outlet orifice of said nozzle.

80. A device for performing a needleless hypodermic injection of a liquid medication contained in a medication unit within the device, said device including pyrotechnical means for generating within the device a pressure necessary for injecting the medication, said device comprising ignition means for igniting a propellant contained in said device, said device further comprising

(a) a housing which is so configured and dimensioned that it is adapted to withstand or uptake alone, i.e. by itself, said predetermined internal pressure value,

(b) a first chamber within said housing, said first chamber containing a medication unit configured and dimensioned to store a volume of liquid medication to be injected, said medication unit having a first region and a second region that are in liquid communication with each other, said first region being deformable and said second region having an ejection outlet,

(c) a second chamber within said housing, said second chamber containing a propellant, said first chamber comprising two zones, a first zone containing said medication unit and a second zone which is in communication with said second chamber, so that upon ignition of the propellant in the second chamber gas generated thereby expands into said second zone of said first chamber, exerts pressure on and deforms said deformable first region of said medication unit and thereby causes ejection of said liquid medication through said ejection outlet, and

(d) ignition means comprising a piezoelectric spark generator.

81. The device according to claim 80, wherein said propellant is contained in a propellant chamber having a wall which has a zone of reduced thickness which upon ignition of said propellant bursts and thereby forms an opening of said wall when gas pressure within the propellant chamber exceeds a predetermined value.

82. A device for performing a needleless hypodermic injection of a liquid medication contained in a medication unit within the device, said device including pyrotechnical means for generating within the device a pressure necessary for injecting the medication, said device comprising ignition means for igniting a propellant contained in said device, said device further comprising

(a) a nozzle body, and

(b) a rigid housing,

said housing having a first open end adapted to receive and be connected with the nozzle body and a second closed end,

the interior of said housing defining a chamber which extends between said open end and said closed end of the housing, said chamber being adapted to receive

a first deformable diaphragm which together with a cavity of said nozzle body forms a medication chamber suitable for receiving a predetermined amount of a medication, and

a second deformable diaphragm a portion of which extends around a portion of said first deformable diaphragm,

said second deformable diaphragm and said housing forming together a chamber for receiving a propellant and means for igniting said propellant,

said nozzle body having at its outer end an orifice which is the outlet of a channel for ejecting said medication out of said chamber when a gas pressure generated by ignition of said propellant is applied to said second deformable diaphragm and thereby to said first deformable diaphragm

said means for igniting said propellant comprising a piezoelectric spark generator.

83. The device according to claim 82, wherein said nozzle body and said housing are integrally built as a single-piece element and are made of one and the same material.

84. The device according to claim 82, further comprising venting means for venting of the space comprised between the first deformable diaphragm and the second deformable diaphragm.

85. The device according to claim 82, without said second deformable diaphragm.

86. A device for performing a needleless hypodermic injection of a liquid medication contained in a medication unit within the device, said device including pyrotechnical means for generating within the device a pressure necessary for injecting the medication, said device comprising ignition means for igniting a propellant contained in said device, said device further comprising

- (a) a rigid medication container having a medication zone for receiving said liquid medication,
- (b) a nozzle in fluidic communication with said medication zone, said nozzle having an outlet orifice,
- (c) a propellant zone where said propellant is located within said device,
- (d) a channel that fluidically connects said propellant zone with said medication zone,
- (e) piston means slidably arranged within said channel, so that upon ignition of said propellant gas pressure generated by combustion of the propellant causes displacement of said piston means which then exert pressure on said liquid medication and eject it through the outlet orifice of said nozzle and
- (f) ignition means for igniting said propellant, said ignition means comprising a piezoelectric spark generator.

87. A device for performing a needleless hypodermic injection of a liquid medication according to any of the preceding claims, wherein said propellant is a one-piece propellant pellet.

88. The device according to claim 87, wherein an ignition layer is in contact with or is an integral part of said one-piece propellant pellet.

89. The device according to claim 87, wherein said propellant is an array of one-piece propellant pellets having each a predetermined shape, a predetermined chemical composition and a predetermined relative position within the array.

90. The device according to claim 89, wherein an ignition layer is in contact with or is an integral part of said array of one-piece propellant pellets.